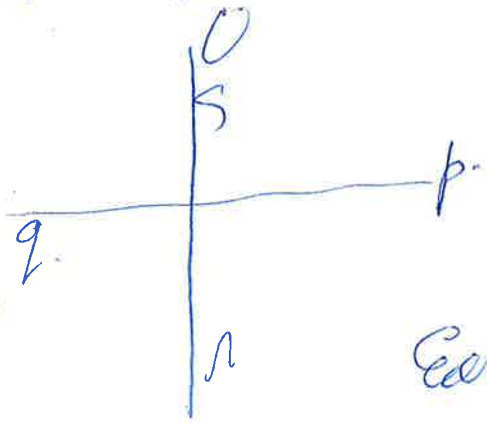
W. C. Salmon [1977] Noûs 11, pp. 253–292
'The Philosophical Significance of the One-Way Speed of Light'

Suggests conventionality of ε value.

But cf.

D. Malament [1977]: 'Causal Theories of Time and the Conventionality of Simultaneity' Noûs, 11 pp 293–300.



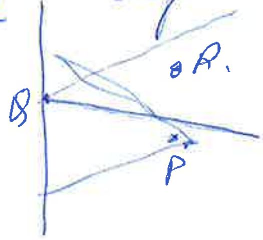
$Sim_O(pq) \Leftrightarrow \langle p-q \mid r-s \rangle = 0$

$\downarrow \varepsilon = 1/2$ conv.

Easily proved in the paper.

Robert then shows if S is an equivalence relation then $S = Sim_O$ (i.e. $\varepsilon = 1/2$)

But S_ε does not define an equivalence relation



$P\, S_\varepsilon\, Q$
$Q\, S_\varepsilon\, R$
But $P \not S_\varepsilon R$.

P. Caldirola and E. Recami [1981],
'Causality and Tachyons in Relativity'
M.L. Dalla Chiara (ed.)
in ~~D Chiara and M. Luisa~~ (~~eds~~.)
Italian Studies in the Philosophy of Science (Dordrecht: D. Reidel)
pp. 249–298.

good up-to-date summary of tachyons.

J. Earman [1972]: 'Implications of Causal Propagation Outside the Null Cone'. Australasian Journal of Philosophy 50 pp. 222-237.

Refers to P. Havas Boston Studies Vol 5 (1969) 'Causality Requirements, Rel. Theory'.

General approach is to resolve causal loop paradoxes by [illegible] solutions possible [illegible] without the causal loop

- cf [illegible] effect
- [illegible] a [illegible] [illegible] [illegible]

many [illegible].

[illegible], [illegible] Formulation of CT

Ansatz for doing the Lorentz transformation Galilei transformation in [illegible] Transformation

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Rev. R. Ac. Cienc. Madrid 61 (1967)

555 - introduces idea of general contraction (longitudinal & transverse) and time dilation as a basis for various sorts of relativity transformation.

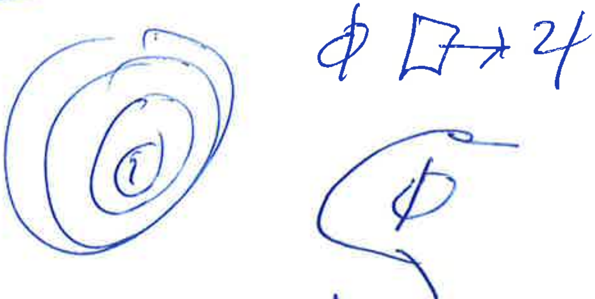
Kar Relativity in the acoustical world Ind. J. Phys. 18 (1970) 1, derives acoustical transformations by just replacing c by vel of sound, i.e. how would world behave if sound were the invariant

D. Lewis Counterfactuals - 1973

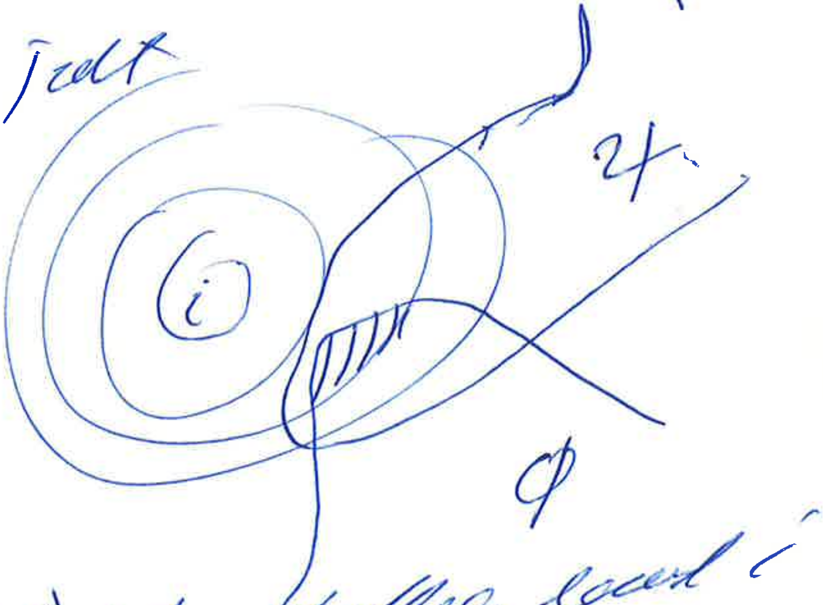
Defn of $\phi \Box\!\!\rightarrow \psi$ given on p.16

In vacuous case we say
ϕ is not entertainable at i.

a) Vacuous truth



b) Non-Vacuous truth



Defn of a (centred) system of spheres around i
is given on p.14.

O. Bilaniuk, V. Deshpande and E. Sudarshan
"'Meta' Relativity": Am. J. Phys. 30 (1962) 718-723.

refer to prerelativistic treatment (e.g. Thomson (PM 28 (1889) 13), Sommerfeld & Heaviside. Notes that tachyons have imaginary mass but this is not measurable (only p, E which are real)

G. Feinberg "Possibility of Faster-Than-Light Particles": PR 159 (1967) 1089 – 1105.
introduces the name 'tachyon'.
discusses various objections to tachyons

1.) E, p → ∞ as v → c but v > c allowed
2) E, p become imaginary for v > c, m → im.
3.) Negative energy states available } RIP Principle
4.) 'backward' propagation in time }
5.) tachyons used to synchronize clocks ⇒ abs. frame, but laws of physics not invariant under this new time synchronization

F. says there are no finite-dimensional reps of Lorentz group with imaginary mass other than scalar reps.
Considers $(\Box^2+\mu^2)\phi=0$.
tachyons cannot be localized – also vacuum does not have no particles for all observers.
L changes no. of particles present (cf RIP).
Also tachyons are fermions, in spite of having spin 0.
vacuum is not invariant under L.

R. Goldoni; 'Faster-than-Light Inertial Frames and Tachyons'. N.C. 14A (1973) 501, 527.

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develops theory of faster-than-light inertial frames as well as particles – i.e. two meta-relativity extension of the work in 1 dimension of L. Parker P.R. 188 (1969) 2287. In this way Goldoni develops a theory which is quite symmetrical between slower & fast. worlds. Goldoni also first to coin the term bradyon in place of tardyon for $v < c$ particles.

E. Wigner 'Relativistic Invariance in Quantum Mechanics'. N.C. 3 (1956) 517. Gives good qualitative discussion of the ideas applied to elementary systems – suffers inadequate role of the inhomogeneous full Lorentz group i.e. includes spatial, temporal inversions (in view of doubts later cast on P, T conservation – this should better be replaced by proper group only) (refers to Furry P.R. 51 (1937) 175 for discussion of C symmetry, also later references)

P.L. Csonka 'Causality and ~~the~~ faster than light particles'. Nuc. Phys. B21 (1970) 436-444.

Gives good discussion of the Newton (1967) and Rolnick (1969) causal paradoxes – argues that they do not show tachyons to be inconsistent only that certain initial conditions cannot be realized. Rolnick's conclusion was ~~that~~ that interaction between bradyons and tachyons is not logically possible.

J.J. Thomson 'On the magnetic fields produced by motion in the electric field'. PM 28 (1889) 1.

Considers case of velocity > c for the moving electrified sphere (calculates the magnetic field)

R. Clay & P. Crouch Nature 248 (1974) 28.

'Possible observation of tachyons associated with extensive air showers'.

J. Maund 'Tachyons, causal paradoxes' F.P. 9 (1979) 557

very complete discussion

N.B. $t_2' - t_1' = \gamma(t_2 - t_1)(1 - vu/c^2)$ so time reversal if $vu > c^2$ and $v > \frac{c}{u} \times c$, possible if $u > c$

But $E^* = \gamma(E - pv)$ where $p = \sqrt{E^2 + \mu^2} = mu = \frac{Eu}{c^2}$

$= \gamma E(1 - uv/c^2)$, changes sign when $uv > c^2$.

A. Everett: 'Tachyons, Broken Lorentz Invariance, and a detectable light carrier'. P.R. 13 (1976) 785, 795. describes generalization of S.R. where ether invisible to S.R. for $\beta < 1$-d, due a very small one no

A. Antippa & A. Everett P.R. D8 (1973) 2352
'Tachyons, Causality, Rotational Invariance'
extends the 1-dimensional model of Antippa & Everett (1971) to 3-dimensions by introducing a preferred direction in space — a tachyon corridor — this idea is extended in
Antippa P.R. D11 (1975) 724.

W. Rolnick P.R. D6 (1972) 2300
rejects the Parmentola & Yee analysis of the Pirani Paradox. He claims the only solution of the causal paradox is to forbid certain types of tachyon emission — this is Rolnick's Boundary Condition now adopted by Csonka. See also
R. Fox P.R. D5 (1972) 329. (tachyons and E.P.R. very important reference)

R. Fox 'Tachyons and quantum statistics' P.R. D5 (1972) 329-331.

discusses explanation of EPR experiment in terms of a tachyon field (cf Bohm's quantum potential). Explains no causal paradox since information at wrong place (essentially my point) refers to suggestion for low-energy p.p scattering to test EPR in R. Fox Lett. N.C. 2 (1971) 565

M. Gluck P.R. 183 (1969) 1514.

Correction to Dhar & Sudarshan (1968) — a Lorentz-invariant tachyon propagator is not expressible as a retarded Wightman function.

R. Newton 'Particles that travel faster than light'. Science 167 (1970) 1569

suggests that causal paradoxes can be avoided for tachyons unless large changes in velocity allowed.

E. Recami and R. Mignani

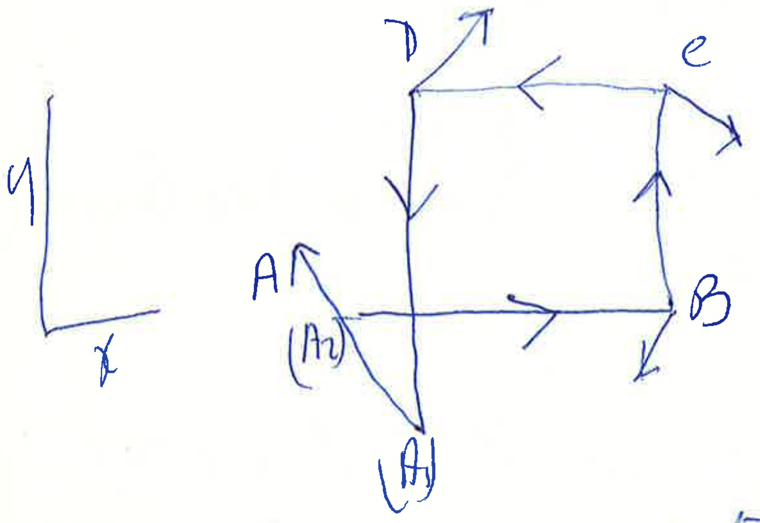
Classical Theory of Tachyons.
(Special Relativity Extended to Superluminal Frames & Objects)

Rivista del Nuovo Cimento 4 (1974) 209–290.

Tachyon theory really originated with Bilaniuk, Deshpande and Sudarshan Am. J. Phys. 30 (1962) 718, Feinberg, P.R. 159 (1967) 1089.

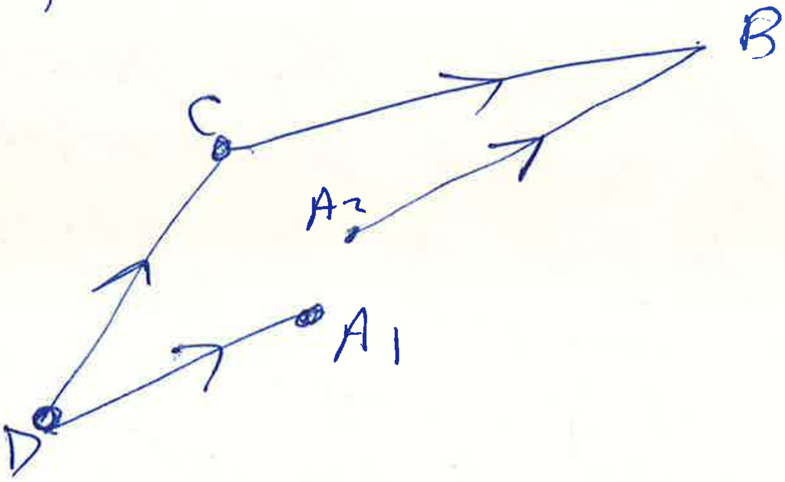
Transcendent vel. for tachyons plays same role as zero velocity for bradyons (zero energy for v=∞ so we cannot in any frame transmit a finite amount of energy with infinite velocity) but they do transmit information.

Note that causal connectibility is not an ~~[illegible]~~ invariant relation in tachyon signalling. — cf discussion of the Pirani Paradox (1970)


D
C
y
A
B
x
(A2)
(A1)

But what A sees is initial pair created at D and an final pair annihilated at B. Events (A1) & (A2) are not seen as causally connected at all.

Thus



M. Podlaha, E. Navrátil

"On the linearity of the Lorentz Transformation"
Acta Physica Austriaca 24 (1966) 99-100.

Assume ~~$x_i' = f_i(v, x_j)$~~ $x' = f_1(x\,y\,z, t, v)$

$y' = - \; -$

$t' = f_4(v\,x\,y\,z\,t)$

then Principle of Homogeneity as

~~$x_i' - x_k' =$~~

$x_2' - x_1' = F_1(v, x_2 - x_1, y_2 - y_1, - \; -)$

or $f_i(v, x_2\,y_2\,z_2, t_2) - f_i(v, x_1, y_1, z_1, t_1)$

$= F_i(v, x_2 - x_1, y_2 - y_1, z_2 - z_1, t_2 - t_1)$

$$\left.\begin{aligned} \text{Hence } \frac{\partial f_i}{\partial x_2} &= \frac{\partial F_i}{\partial (x_2 - x_1)} \\ -\frac{\partial f_i}{\partial x_1} &= -\frac{\partial F_i}{\partial (x_2 - x_1)} \end{aligned}\right\} \therefore \frac{\partial f_i}{\partial x_2} = \frac{\partial f_i}{\partial x_1}$$

for any x_2, x_1

so $\frac{\partial f_i}{\partial x} = A_i(v)$

$\therefore f_i(v, x, y, z, t) = A_i(v)x + B_i(v)y + C_i(v)z + D_i(v)t + E_i(v)$

and hence is a linear one.

i.e. we assume transformation preserves as equal distant spaces.

According to Roller Lorentz follows since ~~velocity~~ uniform vel. relative to K must also be uniform relative to K'

$$u_x' = \frac{\frac{\partial f_1}{\partial x}dx + \frac{\partial f_1}{\partial y}dy + \cdots dt}{\frac{\partial f_4}{\partial x}dx \cdots - \frac{\partial f}{\partial t}dt}$$

$$= \frac{\frac{\partial f_1}{\partial x}u_x + \frac{\partial f_1}{\partial y}u_y + \cdots \frac{\partial f_1}{\partial t}}{\frac{\partial f_4}{\partial x}u_x + \cdots \frac{\partial f_4}{\partial t}}$$

= const. if u_x u_y, u_z are any constants.

This requires $\frac{\partial f_1}{\partial x}$ = const $\frac{\partial f_1}{\partial y}$ = const — —

R. Redhead 'Note on the Axioms of the Special Theory of Relativity'. Acta Physica Austriaca 17 (1964) 266–270

derives Lorentz transformations from 2 axioms

1.) Reciprocity condition (~~Prob~~ Principle of Relativity) $x' = f_1(v, x, \ldots t)$ etc

$\Rightarrow x = f_1(-v, x', \ldots t')$ etc.

and 2.) Addition of Two — refers to other mean systems,

Stiegler. N.C. 13 873 (1959)

Ahrens. Am. J. Phys 30 34 (1962)

use contraction of rod & rel. of clocks ⇒ Lorentz.

L. Sklar: Space, Time and Spacetime

U. California Press 1974.

Introduction ch I says book is aimed at philosophy of physics

Ch II the epistemology of geometry: begins with history of Euclidean & non-Euclidean geometry — Gauss's theory of surfaces — Riemann theory of curved spaces — discusses generalization of Riemann geometry — including Weyl space in which a rigid rod moved around a closed loop is not congruent with itself (non-integrable nature distance is characterized by two forms g-function (quadratic) and linear form φ. Also clock moved round closed loops would on return not be ticking at same rate

S. then discusses conventionalist views on geometry Section H p. 112 et seq. is entitled The panorama of philosophical perplexity. — gives good account of possible reactions to conventionalism

— Refers to papers in Chiu, H. and Hoffmann W. Gravitation and Relativity.

In ch III S. discusses absolute motion and substantival spacetime. Newton.
- discusses Leibniz versus Newton.
good account that on Clarke and Leibniz [illegible] motion w.r.t. matter, latter cannot necessarily be identified with absolute space.
- S also discusses Mach v. Newton, and non-Machian aspects of G.R.
- refers to Horwich AMP 36 for discussion of neo-Newtonian spacetime

In ch IV S. discusses Causal order and temporal order.
Gives [illegible] generalization to null-result of round trip expt. light takes same time to travel in polygonal path to starting in either direction (= vel. of light (one-way) is independent of motion of reference frame) - continues with good general treatment of special relativity
- continues with discussion of G.R. - for closed time-like world lines etc - does not regard this as logically impossible - imposes constraints on initial conditions - must be such as to bring about the present state at some future time

5. discusses how we may reinterpret this situation in terms of identical world states at different times (contradicts Leibniz's identity of indiscernibles)

Refers to J. Earman 'Implications of Causal Propagation outside the Null Cone' (re Tachyons) Australasian J. of Phil. 50 (1972)

cf J. Earman 'Notes on the causal theory of time' Synthese 24 1972. (deals with nonstandard causal topologies)

Ch V deals with the direction of time.

In ordinary conceptual scheme asymmetry shows itself in respect of

1.) Knowledge of Past & future
2.) Existence. (future is of possibilities only)
3.) Possibility (past devoid of possibility)
4.) Causation
5.) Concern (Past pains we remember with unpleasantness, future " " anticipate with anxiety)

S. continues with a good account of symmetry - in particular time reversal.

If $S \xrightarrow[\Delta t]{} S_1$

then $T(S_1) \xrightarrow[\Delta t]{} T(S)$ $T(S_1)$ is time reversed state of final state.

S. gives a good account of de facto irreversible processes such as expansion of the universe, radiation etc

Good account of Wheeler-Feynman action-at-distance theory (absorber) of radiation reaction — assumes backward causation in time — but instead correlation and good that appearance of correlations of particle motions is always forward in time

Good section on statistical physics Gibbs on
— distinguishes Boltzmann's

H-theorem

S. then distinguishes Time orientability from the direction of time. — certainly if laws of physics are non-T invariant. Spacetime must be orientable

S. discusses what can be concluded from T-invariance (a set of laws.

e.g. T-invariance does not exclude sequence of states $s(t_1)$ $s(t_2)$ as defining a direction of time (because T-invariance makes the notion of a reversed state)

also T-noninvariance of some law states $s(t_1)$ $s(t_2)$ exist $t_2 > t_1$ and that $T S(t_1)$ $T S(t_2)$ $t_2 > t_1$ is not possible But this pair of states might not be realized in fact.

S argues against a relationist view of direction of time in terms of sequences of physical events. (cf Grünbaum)

Refers to O. Penrose. 'Foundations of Statistical Mechanics' for Gibbs H theorem.

Also cf J. Blatt. Prog. Theor. Phys. 22 (1959) (approach to equilibrium due to non-isolation)

also Wheeler, Feynman RMP. 21 (1949) (action-at-distance)

or RMP. 17 (1945) — absorber theory.

General reference on Differential geometry is
Spivak, M A. Comprehensive introduction to Differential Geometry (2 vols).

References for non-standard topologies in G.R.

Kronheimer, Penrose.
'On the Structure of Causal Spaces'
Proc. Roy Soc A 63 (1967)

B. Carter 'Causal structure in Space-Time
G.R. & Gravitation 1 (1970)

Geroch, R. 'Singularities' in
M. Carmeli, S. Fickler and L. Witten (eds)
'Relativity'.

Bas. C. Van Fraassen : An Introduction to the philosophy of Time and Space. Random House 1970.

The book is basically intended to provide an introduction to the work of Grünbaum and Reichenbach.

ch I concerns Basic issues in the philosophy of Time and Space.

ch II is concerned with Theory of Time: Aristotle to Kant. — good treatment of Aristotle's Physics. "Time is a numerable aspect of process". It is not to be identified with process, which was Plato's view — really a theory of duration rather than of time.

Aristotle on change; involves 1) A thing which is changed, 2) an initial condition, 3) a final condition.

For essential change. initial, final conditions must be of same kind (hence incompatible) musician [illegible] pass

If of different kind (e.g. [illegible] prior to taking a walk) initial, final conditions are compatible — change, says Van F.) or the accidental.

Essential changes are of various kinds

generation from a nonsubstantive (ex not-white) to
a substantive (ex. white)

destruction inverse of generation.

movement or process is change from one
substantive to an incompatible one.
e.g. white to black.

movement may be change w.r.t. quality (colour)
quantity (eg. length) or place. (local motion)
Van F. discusses Aristotle v. Aquinas on Eternity
of motion (A says no beginning or end to motion
— denied by Aquinas who wants to give an
account of theological doctrine of creation.)

space
Barrow rejects Aristotle's view that time
is an aspect of motion. — extreme absolutist
— time exists even if no motion takes place

2 Absolute time favored by Barrow's pupil
Newton. — But challenged by Leibniz
cf Clarke – Leibniz correspondence
(H.G. Alexander ed. The Leibniz – Clarke
correspondence)

After an extended treatment of Leibniz
Von F. discusses Kant — [illegible] notion of time and classical physics — developed further by Lechalas in 19th century — both Leibniz and Lechalas are forerunners of modern causal theory of time.

ch III discusses Time in 19th century,
— Whitehead's theory of natural sciences,
— topological features of time.
— discussing nature of time — (Poincaré v. Russell); Irreversibility of time.
— thermodynamics & physical sciences
— theory of [illegible] — rather brief simple treatment of these issues discussed.

Time & mind next discussed
Is time independent of the mind
[illegible] says ~~no~~ yes (depends only on nature)
Avicenna says no.
Duns Scotus says: insofar as time is aspect of movement it is independent of mind, insofar as it is a measure it depends on existence of a being able to measure.

ch IV Classical problems of theory of space.

Van F. discusses Newton v. Leibniz.
— also Berkeley's attack on Newton's absolute space (in De Motu), refers to Euler's 'Réflexion sur l'espace et le temps' — supports absolute space.
— Van F. next discusses theory of Geometry
— Euclidean, Non-Euclidean. — Poincaré's conventionalism.
Finally v. F. discusses measurement of space (cf Lucas for better account)

ch V Theory of Relativity this is best chapter in book.
— good treatment of Clock-Paradox.
derives Lorentz transformations essentially using K-calculus. with a Durational Postulate "A clock measures space-time intervals along its own world line"
refers to H. Törnebohm 'Concepts & Principles in the Space-Time Theory within Einstein's Special Theory of Relativity' — 1963.
H. Bondi 'Relativity & Common Sense' 1964.
introduced K-calculus — term due to Bohm.

ch VI discusses the causal theory of time & space-time.

20th century saw 2 lines of development

1.) Robb, Russell, Whitehead
Our Knowledge of the External World (1914), The Analysis of Matter (1927)

2.) Reichenbach, Mehlberg, Grünbaum

philosophy of space & time
expanded version in The Direction of Time

Phil. Problems of Space & Time
and Modern Science
& Zeno's paradoxes.

criterion of cause was the mark method:
small variation (mark) in E_1 is associated with mark in E_2 but not vice versa
then E_1 is cause of E_2

But this depends on concept of time-order
- mainly because need 2e [illegible]
- clock mark must not be [illegible]
- critique of Mehlberg and of Grünbaum

↳ in Direction of Time defines not time order but rather of betweenness

Van F. continues with extended discussion of Grunbaum's causal theory of time

Finally Van F. discusses his own contributions to the causal theory of time.

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p.30 – 35. Van F discusses physical objects & events.

a state of affairs ≡ state of all bodies existing

Process ≡ sequence of changes ≡ sequence of states. of states of bodies

Event ≡ change in state = limiting case of a process (series of states with only 2 members)

An event is really a short lived state

If you set a room for 1 hr and put off light for 1 sec we say "All that followed (second) the light was off for 1 second".

Cf Bridgman (A Sophisticate's Primer of Relativity)

Event implies a 'happening' of some sort. 'We are not likely to speak of a book resting passively on a table as an 'event'' (Surely it is a succession of events (Book persists for short time in position P - relatively))

Events happen, things exist (or persist) and states of affairs obtain

1

R. Swinburne   Space & Time, Macmillan 1968.

this book adopts an ordinary language approach to concepts of space & time. It is concerned with charting logically possible properties which space & time may have, only secondarily with the most general contingent properties.

Introduction explains distinction between necessity & contingency.

ch I is on place & matter. A place is where a material object is. Anything which can be said to have a place is called a spatial thing.

1) Material objects, by defn. two such cannot occupy same place

2.) mere physical objects such as fields which can interpenetrate. — that only material objects are spatial is argued by Quinton in Mind 1964 74, 332.

ch2 is entitled Space. A space is a collection of places. — refers to some technical philosophical papers. — Are all places spatially related to one another? Quinton argues no not necessarily in Philosophy, 1962 37 p.130.

also · is spatio-temporal continuity a necessary condition for personal identity.
cf. Williams, Proc. Arist. Soc. 1956 57 229
and papers in 'Analysis 1958–1962 by Martin, Werlich, Coburn, Williams & Shorter.

ch 3 is concerned with absolute space
– discusses Newton, Rad etc

ch 4 Distance & Duration – Primary tests
– using stepping off of rigid rod.
– 3 surface test for a plane –
shortest distance test for a St line etc.
To correct for measurement we need a geometry.
Ga, if Gr results from corrected measurement
we require GR = GA. cf Grünbaum
Fund: Phil. Sci 1964 31, 156.
'Physical Geometry and Physical Laws.'

ch5 Distance & Duration – Secondary Tests
discusses celestial measurements
– refers to J. D. North 'The Measure of the Universe', 1965.

ch 6 the Geometry of Space.
discusses non-Euclidean geometries.

ch 7 The Dimensions of Space.
- makes the point that dimensionality = no of distance measurements required to locate a point, not just no of coordinates.

ch 8 Past and Future considers philosophy of Time

Spatial things exist, anything during which a spatial thing could exist is a period of time. Events are changes of states of of things.

S. says of logical necessity actions of agents and other causes can only affect the present or future, not the past.

note I ~~can~~ cannot change the past or the future. To change something is to make it different from what it ~~is at a moment of time to~~ was at another instant. But the future is what does occur. This is fixed. But I might be able to cause or bring about the past as also the future.

Many philosophers claim we can in principle effect the past — Ayer, Russell, Dummett 'Bringing about the past' Philosophical Review, 1964, 73, p. 338. This is supported by Scriven, Analysis, 1956, 17, 5 and by Chisholm & Taylor in Analysis, 1960, 20, 73.

↳ 'Making things to have happened' — see Mackie Phil. Rev 1966, 75, 441 'The Direction of Causation'.

But this denied by S. also by

Flew 'Can an Effect precede its Cause' Proc. Arist. Soc. Sup. Vol. 1954, 28, 45

Black. Analysis 1956 16, 49.

Flew " " " 104.

Pears " 1957, 17, 54.

Flew " 1957, 17, 81

Dray " 1960, 20, 79 (reply to Chisholm & Taylor)

Gale "Why a cause cannot be later than its effect' Rev. Met. 1965, ~~209~~ 209. 19

S. says Gödel's idea is ruled out by argument since closed timelike world lines are logically impossible. (see Gödel in RMP 1949, 21 447) and Einstein Schilpp volume.

ch 9 Logical limits to Spatio-temporal knowledge.
— Time-travel is not logically possible says S

ch10 Time and the topology of time.
discusses whether we can have 2 times
S argues, as with places, this is not logically possible

ch11 Time Measurement and Absolute Time
— gives good account of special relativity, particularly pp. 218 – 226
— also discusses measurement of time in Cosmology.

ch12 Physical limits to knowledge of the Universe i) Horizons
discusses problems of event horizons in G.R. S argues we do have some knowledge of objects beyond event horizon e.g. that they recede from us at speeds > light.

ch13 discusses signal asymmetry of Past & Future
— discusses H theorem, asymmetries of el light cone etc

{ch 14 The size and geometry of the Universe.
{ch 15 The Beginning & end of the Universe.

these questions are discussed both from the point of view of Kant and of modern cosmology.

Refers to / Sciama: 'The Age of the Universe'
BJPS). 1954, 5 181
{ Hare', 'Philosophical aspects of Cosmology'. BJPS, 1962, 13, 104-19.

— believe like Kant, but unlike S, that coherent talk about Universe as a whole and whether it had a beginning in time etc is impossible.

S ~~cites~~ cites in support of his views C.H. Bird 'The beginning of the Universe', Proc. Arist. Soc., Supp. Volume, 1966, 40 p. 139-50.

C. W. Rietdijk Proof of a Retroactive Influence. Found. Phys. 8 (1978) 615. — discusses retroaction in the context of EPR.

R. Weingard 'Black holes' Synthese 42 (1979) p. 191 gives good account of philosophical issues refers for discussion of geometrodynamics to Misner, Wheeler 'Classical Physics as Geometry'. Annals of Physics 2 (1957) 525 very good treatment of Maxwell [illegible] unified approach to electrogravitation [illegible]

also J. Earman J. of Phil. 69 (1972) 634 for phil. discussion of geometrodynamics

Chisholm, Taylor Analysis 20 (1960) 73

argue for retrocausation on the ground that "there is nothing in the causal relation ~~except so~~ other than .. sufficiency

To argue for cause as defined to be prior in time is "merely a point of vocabulary"

W. Dray Analysis 20 (1960) 79

replies no dependence between a cause (not bringing E about) and a sign of E. cf fall of barometer

(But what about causal branching chains;

Dummett in Arist. Soc. Supp. volume 28 1954, 27 argues for quasi-causes (sufficient, and succeeding) as opposed to causes (sufficient, preceding)

Scriven Analysis 17 (1956), 5 rebuts Dummett with randomizer example.

Randomizer between C and E prevents

production of E by C, so E and
the thought of as (quasi) cause sufficient to
explain causal chain leading to E
(this not quite Scriven's example)
Or consider a ball which has received
motion after friction brings it to
rest. final state is sufficient
cause of motion. Initial state
(of rest) is not sufficient. This
is the sort of example also
considered by Dummett in his
paper On bringing about the past
Phil. Rev. 73 (1964) 338.
Dummett explains that we cannot
have 3 things together
(foreknowledge, free action and forward
causation) or (knowledge of the past,
free action and retro causation)

thus we cannot change the past or the future but we could conceivably do something to determine or bring about the past or future.

R. Gale Rev. Met 19 (1965) 209 gives a very clear discussion opposing Dummett.

We identify cause with an intentional action or something that could be brought about by an intentional action. Then we say we are precluded from knowledge of the future for planned action and of the past by this convention. But we do have records (and memories) knowledge of the past. ∴ whereas is not logically possible i.e. we have here a conflict between intention and memory.

J.L. Mackie 'The Direction of Causation' Phil. Rev. 75 (1966) 441 – 466 argues for 3 sorts of priority: temporal, causal and between what is fixed and what is undetermined and priority w.r.t. direction of order.

He relies on the notion that the future is unfixed in the sense that we can control it (seems modelled on this notion of fixity). Mackie says it is a conceptual fact that these ~~those~~ notions coincide: B is the cause of A if ∃ an interval of time at which A is fixed but not B, because we could in advance of A decide not to fix B. o. B causes A is feasible only if B is fixed at a time when A is still unfixed.

Motion and Time, Space, and Matter

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ed. P.K. Machamer and R.G. Turnbull

A lot of historical essays.
Relativity discussed by. K.F. Schaffner
and W. Salmon (as reprinted in
Space Time, Motion).

E. Recami (ed.) Tachyons, Monopoles, and Related Topics. North Holland - Amsterdam, New York, Oxford (1978).

Good survey article by Recami. 30

Trefil discusses causal paradoxes 4

Sudarshan discusses preferred frames. 7

Kamoi, Kamefuchi give good discussion of QFT of tachyons.

Ferrari gives good introduction to Monopoles — refers to Dirac Phys. Rev. 74 814 (1948) as most fundamental paper on the subject.

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another important reference is
J.M. Maund Found. Phys. 9 (1979) 557.
'Tachyons and causal paradoxes'
— very clear discussion of the antitelephone paradox (ATP) with many references

and

E. Feenberg Distant Synchrony and the 1-way velocity of light. Found Phys 9 (1979) 329.

Discusses rotating shaft etc — not very profound (calculates state of rotating shaft with non-standard synchrony)

Mansouri, R and Sexl, R.U. 'A Test Theory of Relativity: I. Simultaneity, Clock Synchronization and Special Relativity', Gravitation, 8 (1977) 497-513

Gives good historical background to definition of simultaneity.
Discusses Tangherlini transformation, Lorentz + modified velocity addition formula

$$w = v + u(1-v^2) \qquad \left(\text{cf } w = \frac{v+u}{1+uv}\right)$$

$\uparrow$ vector vel. | reference frame S | S-frame velocity.

$\Rightarrow$ anisotropic light velocity.

$$t = \sqrt{1-v^2}\, T$$
$$x = \frac{1}{\sqrt{1-v^2}}(X - vT)$$

$$\frac{x}{t} = \frac{1}{1-v^2}\left(X/T - v\right)$$

or $u = \frac{1}{1-v^2}(w - v)$ or $w = v + u(1-v^2)$

reference to Robertson RMP. 21 (1949) 378 for deriving Lorentz Trans from Michelson-Morley, Kennedy-Thorndike and Ives-Stilwell.

p.503 ' We thus arrive at the remarkable result that a theory maintaining absolute simultaneity is equivalent to special relativity'

p 512 ' Thus the much debated question of the empirical equivalence of special relativity and an ether theory taking into account time dilation and length contraction but maintaining absolute simultaneity can be answered affirmatively'.

Section entitled ' Relativity without Relativity ' !